DOCUMENT RESUME

ED 064 670 CS 000 026

AUTHOR Smith, Nila Banton
TITLE Instructional Technology and Reading: Progress, Problems, and Promise.
PUB DATE May 72
NOTE 22p.; Speech given at the Annual Convention of the International Reading Assn. (17th, Detroit, May 10-13, 1972)

EDRS PRICE MF-$0.65 HC-$3.29
DESCRIPTORS Audiovisual Aids; Changing Attitudes; Computer Assisted Instruction; Cost Effectiveness; Educational Innovation; *Educational Technology; Instructional Media; *Instructional Technology; *Multimedia Instruction; Reading Improvement; *Reading Instruction; Reading Materials; Systems Approach; Teacher Role; *Teaching Machines; Televised Instruction

ABSTRACT

As the invention of the wheel played a large role in the technological advancement of transportation, so many new teaching devices have played an important role in the technological advancement of reading instruction. Though the spread of technology was initially slow, it now offers many instructional aids (e.g., tapes, records, television, computers, and other teaching machines) in reading usage. The systems approach brought about large scale computer experiments and computers are now widely used in schools' reading programs. Educational television programs (e.g., Sesame Street and the Electric Company) have been very successful in the teaching of reading. Audiovisual aids and other multimedia devices are commonly found in reading instruction. These recent innovations, nevertheless, have many impediments to their gradual acceptance and usage: cost, resistance to change, and dehumanization factors. However, reducing cost through the use of minicomputers, increasing funds for educational technology, cable television, and disseminating multimedia products can help minimize these problems. The reading teacher, too, must become technologically oriented to assist and counsel students in the use of these instruments. With the efforts of the teachers and the use of these new instructional devices, strides can be made in reading instruction. (HS)

ED 064670

Nila Banton Smith
Distinguished Professor
University of Southern California
Los Angeles, California 90007

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION
THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL OFFICE OF EDUCATION POSITION OR POLICY

"PERMISSION TO REPRODUCE THIS COPYRIGHTED MATERIAL HAS BEEN GRANTED BY Nila Banton Smith

TO ERIC AND ORGANIZATIONS OPERATING UNDER AGREEMENTS WITH THE U.S. OFFICE OF EDUCATION. FURTHER REPRODUCTION OUTSIDE THE ERIC SYSTEM REQUIRES PERMISSION OF THE COPYRIGHT OWNER."

CS000 026

Session: Thursday, May 11, 10:30-11:30

INSTRUCTIONAL TECHNOLOGY AND READING: PROGRESS, PROBLEMS, AND PROMISE

PROGRESS

Today everyone is talking about change. We are becoming startingly aware of acceleration in changes taking place within our civilization. Technology indisputably is the major thrust behind these changes. Until the advent of technology progress in civilization was slow and laborious. With the arrival of technology acceleration began.

Technology has changed the patterns of progress in major strands of civilization and it is changing progress patterns in reading, also.

Let's examine the pattern of progress in transportation as an example, and then the pattern of progress in materials and equipment for teaching reading to note similarities in the two progress patterns. Comparison of patterns of progress give us a basis for predicting the future.

Early man transported himself and his goods over sands of the desert with camels, over snowy wastes of the north with dogs, and over the level prairies ~~on~~ with sledges drawn by oxen. At 6000 B.C. the fastest transportation was that of camel caravan at eight miles per hour.

In the meantime the wheel was invented. However, 3,500 years later the first mail coach which began operating in England in 1784 traveled only ten m.p.h. The first steam locomotive of 1825 could reach only thirteen m.p.h. and it undoubtedly was not until the 1800's that man with the help of more advanced technology produced a steam locomotive that could travel one hundred m.p.h. It took civilization millions of years to attain this record in transportation. With a burst of innovative technology it took only fifty-eight years to increase this record four times over. By 1938 airplanes were flying 400 m.p.h. This record was doubled in a mere twenty years. In 1960 rocket planes reached speeds of 4000 m.p.h. and space capsules circled the earth at 18,000 m.p.h. (8).

Quoting from Alvin Toffler "Plotted on a graph, the line representing progress in the last generation would leap vertically off the page" (22).

Thus it is that technology increases by its ~~only~~ own momentum.

A technological innovation calls forth new creative ideas, and these ideas when developed generate other creative ideas. As time passes technology multiplies in staggering exponential terms.

I will now sketch progress in regard to production of reading materials. I think you will note the same general pattern of growth.

The first step in man's attempt to communicate his thoughts to others through materials that required reading was taken in Mesopotamia in 3100 B.C. During that century the Mesopatamians developed a system of word-syllabic writing. From this, various alphabetic systems evolved.

The first great impetus in the production of printed reading material came with the invention of movable type by Gutenberg and others during the decade of 1440-1450. Thus four-and-one-half thousand years elapsed from the time writing began before reading materials could be produced in any way except through the use of the human hand.

Now let us examine, specifically, progress in producing materials and technological aids for teaching children to read. In 813 it was decreed in the forty-fourth Canon of Mainz that all children should be taught the "fiden Catholicam et orationium dominicans." Since children were to receive universal instruction in this content, it became necessary to make it available to the laity; hence the appearance of the first reader containing selections to be taught to children. This was over one thousand years ago, and we're still using readers to teach children the skills of decoding and comprehending printed communication, and probably we should continue to use printed materials of some sort, for how can they learn to read without the use of printed communications?

In the 1920's, however, technology began faintly tracing designs on the age-old medium of books as the sole material for reading instruction. The metronoscope appeared in the twenties as a speed reading device, followed by the tachistoscope, accelerator and all of their descendents in a great variety of forms and nomenclature. It was in the twenties, also that Pressey (17) invented the teaching machine but it didn't catch on. Little was heard about it at the time.

Nothing much happened in the thirties and forties except that there was a multiplication of new tachistoscopic and accelerating devices. In the fifties though, technologically speaking, things began to pick up. In 1954 B. F. Skinner (20) published an article concerning his experiments with the teaching machine and programmed instruction. This article popularized Pressey's invention which had lain practically dormant for three decades. In the fifties, also an occasional report came through on the use of radio in teaching reading - perhaps in some remote location. TV had a little encouragement as a media for teaching reading but this soon died down.

There also were a few rumblings of situations in which teachers of reading used films, film strips, transparencies, slides and overhead projectors. Technology was beginning to take hold in reading. It was making some progress.

In the 1960's astonishing technological innovations came forth!

Not only did all of the technological devices mentioned previously increase in reading usage, with the addition of tapes, records, and teaching machines, but exciting new ones emerged!

In 1961 the systems approach, often called systems analysis

emerged. The systems approach is a technological tool, not a mechanical instrument. It is the system that was used in planning the Apollo 16 Mission to the moon, and all of the other space missions. In 1961 Robert S. McNamara (16) Secretary of Defense, together with a group of engineers developed systems analysis as an approach to the complex problems of global defense. This system is now widely used in military affairs, business and industry, and recently it is entering education, including reading.

In 1962 Omar Khayyam Moore startled laymen and educators alike by showing a motion picture in which three and four-year-old children were using a talking typewriter in teaching themselves to read. This technological innovation had been invented by Richard Kobler and Omar Moore.

In 1966 exciting news came from the Brentwood Elementary School in Palo Alto, California. First grade children there were being taught to read with the use of an IBM 1500 computer. Thus the computer made its entrance into reading instruction.

In 1969 Geddes and Kooi reported a study in which a computer played a management role in a diagnostic project in reading. All this in the 60's!

And then the 70's came with advances in reading technology that are truly spectacular!

In the 1970's we began for the first time to hear about large scale computer experiments, for example: John Grate (6) describes how developmental and remedial reading was taught to elementary and high school students by CAI in the City of Cincinnati, and Richard Smith (21) tells how reading was taught by CAI to elementary

and secondary students in interurban communities in Pennsylvania.

Reports of many, many smaller CAI projects are coming in and what is interesting about these is that they are dealing with different types of children, in many different situations, and under different time-sharing arrangements. Two examples will be given. In Yorktown, New York, Jimmer M. Leonard (15) reports the use of the computer in teaching reading to educationally handicapped children, and to 13 to 17 year-old students who are reading at fifth grade level. The administrators of this district agreed to let the reading instructors use their computer when it was not in use for administrative work. So Leonard says they are "Piggybacking" their computer for reading instruction.

Another instance of "piggybacking," or "time-sharing" as it is more properly called, which gave an elementary school a chance to use a computer, was devised in Billerica (19), Massachusetts. The high school has an IBM 1130 Computer which is programmed by its students in their data processing class. This computer is also being used to teach basic skills of reading to first and second graders in the elementary school. The teachers select reading activities and stories, vocabulary words, etc., and make up questions. The high school students program the materials for use in the computer. Children and their teacher go to the high school to work with the computer.

The computer is used increasingly as a management tool in individualized programs as reported by Baker (1) and Lawrence (14). It generates student programs of study, scores tests and reports student progress, suggests next learning steps, responds to teacher requests such as for a list of special materials or a program of

studies for a new transferee.

So the computer in the 70's is being used at all school-age levels, with different types of children and in many different ways, as well as a management aid to teachers; and the tremendous outpouring of reading research is also being greatly facilitated by the use of the computer for data processing.

In the 1970's television made a dramatic entrance as a medium for teaching reading with the nationwide readiness program Sesame Street, followed by The Electric Company for seven-to-ten-year-olds. Other TV projects for teaching reading have been developed. For example, the project conducted by E. B. Coleman (2) in the Appalachia Educational Laboratory in which reading was successfully taught to 450 children, three to six years of age, by means of animated cartoons shown on closed circuit TV. Caleb Gattegno (4) conducted an experimental commercial program called Pop-Up designed to teach reading, and consisting of one-minute exposures of phonics, words, and sentences. These are a few outstanding examples of the use of TV in teaching reading in the 70's.

TV, and records are used increasingly in teacher training and for conferences.

Teaching machines are frequently used, and speed reading instruments have quite general use. Films, film strips, slides, transparencies, tape recorders are now commonly used in classrooms, and automated multimedia devices for teaching reading may be found in large numbers of schools.

I have traced progress in two fields--transportation and technological media for teaching reading. This was done for the

purpose of pointing out similarity in the two patterns of growth. Whether we examine growth patterns in these two fields or in the fields of agriculture, industry, economy, or any of several other strands of civilization, we find the same pattern--centuries go by and little happens, finally technology enters the scene in small amounts, and grows gradually, over increasingly shorter periods of time, then there is a sudden burst of technology far beyond wildest expectations or predictions. This has happened again and again in other fields. Since the growth pattern of technology in our field has performed thus far in accordance with growth patterns in other fields, it appears likely that we may look forward to an explosion in the use of technology in teaching reading. When this will come no one can predict exactly, but it is well on the way.

PROBLEMS

Now to discuss problems. The implementation of any new trend imposes problems. The introduction of instructional technology in reading is no exception.

Cost. Cost is a big problem, particularly in regard to some of the larger technologies. Computers cost from $4 to $6 million. For educational purposes, however, a computer usually is leased and the estimated cost is based on the number of students which it will serve in a given time.

Booz-Allen-Hamilton conclude that CAI cost per student for 1/6 of a day for a year in a school district of 10,000 for drill and practice would cost $340,000, while in a district of 100,000 it would

cost only $272,000. In the Philadelphia study, expenditure for CAI was projected at 10% of their total budget or about $50 to $60 per pupil per year. Suppes claims that we can aim at $30 per student for CAI drill and practice service.(13). Estimates vary considerably.

The other instructional technology devices cost something, also. The chart (13) that follows shows the relative cost per pupil per year in terms of instructional time of teachers, paraprofessionals, television, films, computer assisted instruction, and teaching machines.

	Cost Per Pupil Per Year					
	Percent of instructional time					
	First	Second	Third	Fourth	Fifth	Sixth
INSTRUCTIONAL INPUT	10%	10%	10%	10%	10%	10%
Teachers	$ 32	$ 32	$ 32	$ 32	$ 32	$ 32
Para-Professionals	16	16	16	16	16	16
Television	20	10	10	10	20	20
Films	30	30	30	30	30	30
Computer Assisted Instruction	200	200	200	200	200	200
Teaching Machines	60	60	60	60	60	60

Computer assisted instruction far exceeds the others in cost, then in order comes: teaching machines, teachers, films (high because of copyright restrictions), television, paraprofessionals. According to the media shown in this table, television is the least expensive.

It seems, however, that the problem of cost is not solved so simply as determining the bare cost of the instrument per student time of use. There are overall expenses to be reckoned with. The subtraction of cost of teacher time, if he or she had been doing the work the instrument is doing; or perhaps eventually the salary of a remedial teacher if the computer or other technology reaches the point in

which it can do the major diagnosis and prescriptive teaching in reading disability cases; the difference in the cost of materials--all of this perhaps on the minus side. On the plus side a share of the work of new specialists in the school who prepare programmed materials, and handle technological upkeep and other problems attendant upon the use of electronic instruments. In reckoning the overall, across-the-board costs, however, many experts predict that the use of technology may even be less expensive in teaching reading than our present practices. There are many costs, however, which we are unable to predict until further developments take place.

Then, too, this is the age of accountability, and schools are being held accountable for producing results in terms of their expenditures of money. So the results which these technologies produce must be taken into consideration. Hence instruments which can reliably measure the degree of attainment of program goals is a key problem in determining effectiveness. Our reading tests have not yet advanced to as high a state of perfection as we would like and are weak especially in testing higher mental processes in reading, and the linguistically different children.

So there are many problems in estimating cost of technology in teaching reading, and it involves more than the cost of the instrument, itself.

Resistance. One of the problems which has confronted innovations since the beginning of time is that of resistance. Earlier in this talk we noted that always there was a time-lag between the appearance of an innovation and its wide acceptance by those who would benefit from it.

Resistance to change is a psychological reaction in which exposure to some new experience breaks up a cherished pattern previously established. This breaking up of the pattern disturbs our equilibrium and it often takes considerable psychic energy and perhaps some pain to construct a comfortable new relationship.

Eric Hoffer (10) says, "We never can be fully prepared for that which is new. We have to adjust ourselves, and every radical adjustment is a crisis in self-esteem. . . . it needs inordinate self-confidence to face drastic change without inner trembling."

In regard to the present problem concerning resistance to educational technology, I will quote from a bulletin published by the U. S. Office of Education in March 1972, and prepared by Lawrence P. Grayson (7), Director, Division of Technology Development.

"To be effective, a change must be accepted and adopted by the people involved. Education, however, has been characterized by a strong resistance to change. Evans (3) observed that this 'problem of resistance is of so much importance that, without its solution, we are in danger of financing massive installations of educational technology hardware which will end up gathering dust in spite of some apparent acceptance here and there.' Any appraisal of future effectiveness which does not consider man's resistance to change will undoubtedly give erroneous results."

It is quite obvious that Grayson is fully aware of man's resistance to change, and the possibility of some problems still arising from this source.

It is true that it takes time for an established institution to make widespread acceptance of innovation but some promising trends

in regard to resistance to the use of instructional technology are in sight. I will discuss them shortly.

Dehumanizing Effect. Another problem is that of meeting the criticism that the use of technology will dehumanize education. Some predict that technology will mechanize instruction, make automatons out of children and replace teachers. It is rather well accepted now that the technologies in reading will become extensions of the teacher, not replacements, but talk about the dehumanizing influence still prevails.

In response to this criticism a few observations and studies will be given. Anyone visiting in the early primary grades will note that children love putting on their earphones and taking instructions from any of several reading devices that make use of recordings. They enjoy this novel way of obtaining instruction. Putting on the earphones and working by themselves seems to make them feel important and sophisticated.

In the grades children sometimes personalize the computer with which they work. The other day Tommy reported, "This morning when the computer said, 'Good morning, Tommy, how are you?', I felt like scratching its back like I do Daddy's." You hear numerous incidents which indicate children's fondness for the computer with which they work.

A controlled study (9) recently made with junior high school students at Stanford University, indicates that computers are more charismatic than teachers. The researchers in comparing controlled groups found that students liked and trusted the computer, they sometimes attributed almost a human role to it, and they felt more

comfortable than with a teacher. Both groups tended to ascribe charismatic qualities to the computer rather than the teacher. However, CAI students were more aware than non-CAI students of the computers unresponsiveness to students' attempts to change the course or content of its lessons.

In none of these situations has technology appeared to have a dehumanizing effect on the students. The media, of course, are tireless, they can repeat endlessly without losing their patience, they don't pass judgments about students' incompetencies, they don't threaten, punish or give low grades. Perhaps in some respects media may appear to some students to be even more humanistic than teachers.

Reading teachers, I am sure would be happy to turn over to computers and other technologies many of the types of learning and teaching situations which call forth unpleasantries and use their energies in higher types of teaching in which their own potential charisma has a chance to function.

PROMISES OF THE FUTURE

Promises in Regard to Problems

Promise in Cost Reduction. Minicomputers which are now being manufactured offer some possibilities in reduced cost. It is estimated that when eight of these minicomputers are inter-connected in a network with 16-bit word lengths and 1-microsecond cycle time, costing $10,000 each, this network could equal the performance of a $1 million computer operating twice as fast with words four times

as long. So these networks of minicomputers appear to have promise in reducing expense.

Then there are economists who plan computer prices in terms of estimated markets of the future. C. Lester Hogan (11) says, "A new marketplace for some 10,000 exceedingly powerful computers might be identified." In terms of this predicated market he says that in 1980, for instance we might have a computer for five thousand dollars which today costs one or two million dollars.

Time-sharing has great promise for economy. Time-sharing has for its goal the concurrent, effective utilization of a single computer by multiple users. A study by a leading computer firm indicates that by the mid-70's time-sharing is expected to account for 60-70 percent of computer revenues. Systems capable of supporting several hundred simultaneous users with one computer are predicted for use by the end of the 70's.

Some of the other technologies lease their instruments at a reasonable price per year. As the demands of the market increase and producers can manufacture in greater quantities, both basic and lease prices probably will be lower.

Plans of the government to fund educational technology are very promising. As you know in 1970 President Nixon proposed NIE, a National Institute of Education. In order to increase the use of technology and media, NIE among other activities recommended instructional uses of computers, cassette television and cable television, course productions for television, games and simulations, and instructional environments.

Later in 1970, The Commission on Instructional Technology went

so far as to recommend a National Institute of Instructional Technology to be included in the general National Institute of Education, requiring a first year allocation of $565 million to launch it and $415 million for its first-year operating budget.

Additional recommendations of funds have been made amounting to a present total of $1.5 billion for educational technology (7). These are not now available but the fact that Congress and a legislatively created commission have considered them is significant.

Promise in Regard to Resistance. It would appear that man's reluctance to accept change in technology is lessening in so far as the length of its periods of endurance is concerned.

A few examples will be given. We have already noted the long time lags in the cycle of invention, exploitation and diffusion of an innovation. It is only at the diffusion stage--the marketing stage--that resistance is felt by the public. Robert Young (23) at the Stanford Research Institute recently made a study of a group of appliances introduced in the United States before 1920--including the vacuum cleaner, electric range and refrigerator, and he found that the average span between introduction and peak production was thirty-four years. However for a group appearing in the 1939-1959 period--electric frying pan, television, washer-dryer combination--the span was only 8 years. The lag has been reduced by 76 percent.

In so far as the technologies for reading instruction are concerned, we have seen how these technologies were first introduced in the 1920's, how they gradually developed through the years, with a spurt in the sixties and spectacular advances in the seventies. This would indicate a breaking down of any strong resistances which

may have existed. There are some who are resistant at present, no doubt. I candidly believe, however, that the great majority of reading teachers are enthusiastic about the instructional technologies, if they have something to say about which ones are to be purchased, how they are to be used, and who will use them.

Promise In New Developments Of The Technologies, Themselves

Cable television. Cable television is looked upon as the media which will introduce a new era in electronic education, and its possibilities in reading instruction are great, indeed (18).

A coaxial cable is a "magic wire" about the thickness of a fountain pen, used for transporting signals that make up television's pictures. By binding together many of these coaxial cables in one broad band it is entirely practical to deliver 20 channels into a school or home at present, with expectation of forty as being common shortly. One 64-channel urban system is under construction and it is thought that channels could run into the hundreds in the future.

With cable television in a school you wouldn't have to choose one program that comes on at a fixed time. You could have multiple program choices and you could have any particular program you wanted at any time you wanted it. You could have several different TV programs going on at the same time in different classrooms if you liked: or you could have these programs at different times in the day, and repeat them with different groups if you wish. The possibilities for instructional programs in the school are unlimited.

Then there are college courses in reading, refresher courses and reading conferences for teachers, contacts with the community

concerning reading--all of which can be served admirably by cable television because with this facility two-way communication is possible. Topics can be opened up for discussion, in classroom instruction. In a broader sense problems in reading might be opened up for discussion between teachers and other teachers, between teachers and minority groups or other groups in the community who are in need of information concerning reading. Cable TV will be superlative for in-service courses for teachers of reading.

It is possible to use a dial telephone, a computer and a CATV screen in giving a series of lessons in the home. The child dials his phone, pushes two small buttons on top of his TV set and then studies by communicating with a central computer which flashes information on the TV screen. This technique of the future is already being employed in about 2000 homes in Reston, Va., where it is being used to give practice in elementary math and drill in arithmetic. It might as well be used to give practice on some of the reading skills.

Computers. Computers will not only be in common use in schools in the future but it is predicted also in homes. John G. Kemeny (12) says that, "By 1990 a computer terminal will be just as commonplace and important a part of American homes as telephone and television sets are today." The world he envisions is one in which each household would be connected to a central computer that would be used by thousands of people at once on a time-sharing basis.

Satellites and Pocket Radiotelephones. In 1971 eight satellites were ordered by United States with a capacity of more than 5,000 telephone circuits plus one for color television. It is quite possible that we will be getting reading helps dropped down from the clouds.

It is even predicted that satellites will eventually replace the television system as we now know it.

Mass production of pocket radiotelephones is on the increase at greatly reduced prices. If your remedial teenager forgets his reading homework perhaps you can reach him via his pocket radiotelphone and tell him to come back and get it.

Cassettes. Cassettes are becoming very popular in education. An audio cassette consists of a small portable machine and snap-in tape cassettes contained in a compact case which altogether usually weighs only about 30 pounds. Prerecordings and blanks can be obtained. There are many prerecordings in the field of reading, and very often come as a part of instructional packages. The video cassette, sometimes called cartridge TV has been making headlines recently. It is predicted that this development has a great future for classroom teaching, teacher training, and in-service courses in reading. The advantage of this cassette is that it is possible to construct a playback unit, of small dimensions which can be connected to the antenna ends of any TV receiver, to reproduce televised material on a cartridge tape in black and white or color.

Multimedia. In addition to the new developments of promise which I have mentioned automated, multimedia for classroom use in teaching reading is coming forth at a prodigious rate. One has but to visit the exciting exhibit of publishers at Cobo Hall during this convention to vividly realize what is meant by the phrase "explosion of technology in reading." Do visit educational exhibits and see the marvelous array of new technological devices for classroom use in teaching reading, as well as the excellent new software material

that is coming through, for we still need software and there are many innovations in this area, too.

The Future Role Of The Teacher

The role of the reading teacher in the technologically oriented school of the future is both promising and challenging. In such a school he or she will become a truly professional person as a director of learning rather than a dispenser of drill and knowledge. Let the media perform these two services so the teacher will be free to attend to those aspects of learning which only a human being is competent to execute. Not all children are going to learn to read with a computer or one of the other instruments. Not all are going to learn to read with the same materials. The teacher will need to function in such important ways as making individual adjustments in materials and the use of different media; counseling with individual students concerning their reading interests and problems; assisting students who need or call for special skills that are not being met by the media; creating materials to be used in the media; viewing the output of students' work with the media to evaluate it and decide if, and in what ways changes need to be made; stimulating and guiding intellectual discussion with groups of students to aid in developing their skills in interpretation, creative, and critical reading; making, at times, televised presentations about reading to homes of the children, or to the entire community.

Undoubtedly it will be 1980 or later before schools countrywide will be technologically centered, but this time is coming, it is already here in a few places, so we may as well be seriously

considering the reading teacher's role. He or she will be a very busy person and an important part of the scene. Most definitely teachers will still be needed.

There always will be moral, social and educational values which cannot be developed solely through the use of machines, but which from now until eternity must be achieved through association of human beings with other human beings. And reading teachers are human beings.

Reading teachers are so human that they worry about the reading problems of the human beings with whom they work each semester, but they are resiliant and soon replace their worries with constructive thoughts about next steps. And that is what they will do when working in the technological revolution--meet each day with constructive next steps.

REFERENCES

1. Baker, Frank. "The Use of Computer-Managed Instruction in Reading." Paper presented at Preconvention Institute I, Instructional Technology and Reading, Seventeenth Annual IRA Convention, Detroit, 1972.

2. Coleman, E. B. "Newsreport Interview." Reading Newsreport, IV (January 1970).

3. Evans, R. I. in Planning for Effective Utilization of Technology in Education, E. L. Marphet and D. I. Jesser, (Eds.) New York: Citation Press, 1969.

4. Gattegno, Caleb. "Newsreport Interview." Reading Newsreport, V (February 1971), 4-9, 57.

5. Geddes, Cleone L. and Beverly Y. Kooi, "An Instructional Management System for Classroom Teachers," The Elementary School Journal, 69 (April 1969), 337-345.

6. Grate, John. "Teaching Developmental and Remedial Reading by CAI to Elementary and High School Students in Cincinnati." Paper presented at Preconvention Institute I, Instructional Technology and Reading, Seventeenth Annual IRA Convention, Detroit, 1972.

7. Grayson, Lawrence P. "Costs, Benefits, Effectiveness: Challenge to Education Technology," Science, 75, 1216-1222.

8. Goldmark, Peter. "Biggest Challenge: Getting Wisdom," Printer's Ink. (May 29, 1964), 280.

9. Hess, Robert D. and Maria D. Tenerakis. "The Computer as a Socializing Agent: Some Socioaffective Outcomes of CAI," Stanford University Center For Research and Development, Stanford, California, 1971.

10. Hoffer, Eric. The True Believer. New York: Harper and Bros., 1951.

11. Hogan, Lester C. "Technological Change," Vital Speeches of the Day, XXXVIII (December 15, 1971), 139-142.

12. Kemeny, John G. "Trends." Quoted in Computer-Assisted Instruction: A Survey of Literature by Albert E. Hickey (Ed.) Newburyport, Mass.: Entelek, 1968, 8.

13. Kiesling, Herbert, J., "On the Economic Analysis of Educational Technology" ("Cost Estimates for Computer-Assisted Instruction") To Improve Learning, An Evaluation of Instructional Technology. New York: R. R. Bowker Company, 1971, 987, 989.

14. Lawrence, Theodore, "The Application of Computer Management to Reading in an Elementary Grade of PLAN." Paper presented at Pre-Convention Institute I, Instructional Technology and Reading, Seventeenth IRA Convention, Detroit, 1972.

15. Leonard, Jimmer M. "Where Computers Work Overtime," Reading Newsreport, IV (January 1970), 28-31.

16. McNamara, Robert S. "Systems Approach? What Is That?", Changing Times (September 1969), 41.

17. Pressey, S. L. "A Simple Apparatus Which Gives Tests and Scores - and Teaches," School and Society, XXII (March 20), 1926, 373-376.

18. Schools and Cable Television, Washington, D. C.: Division of Educational Technology, National Education Association, 1971.

19. Serlin, Janet, "Good Grief: Charlie Brown's Computerized," Reading Newsreport, IV (April 1970), 29-30.

20. Skinner, B. F., "Science of Learning and the Art of Teaching," Harvard Educational Review, XXIV (Spring), 1954, 86-97.

21. Smith, Richard, "How Reading is Taught by CAI to Elementary and Secondary Students in Interurban Communities in Pennsylvania." Paper presented at Pre-Institute I, Instructional Technology and Reading, Seventeenth IRA Convention, Detroit, 1972.

22. Toffler, Alvin, Future Shock, New York: Random House, 1970, 26.

23. Young, Robert B. "Product Growth Cycles - A Key to Growth Planning," Stanford Research Institute, Menlo Park, California, Undated.